7.4 Design of Concrete and Masonry Connections

7.4.1 General

In typical residential construction, the interconnection of concrete and masonry elements or systems is generally related to the foundation and usually handled in accordance with standard or accepted practice. The bolted wood member connections to concrete as in Section 7.3.4 are suitable for bolted wood connections to properly grouted masonry (see Chapter 4). Moreover, numerous specialty fasteners or connectors (including power driven and cast-in-place) can be used to fasten wood materials to masonry or concrete. The designer should consult the manufacturer's literature for available connectors, fasteners, and design values.

This section discusses some typical concrete and masonry connection designs in accordance with the ACI 318 concrete design specification and ACI 530 masonry design specification (ACI, 1999a; ACI, 1999b).

7.4.2 Concrete or Masonry Foundation Wall to Footing

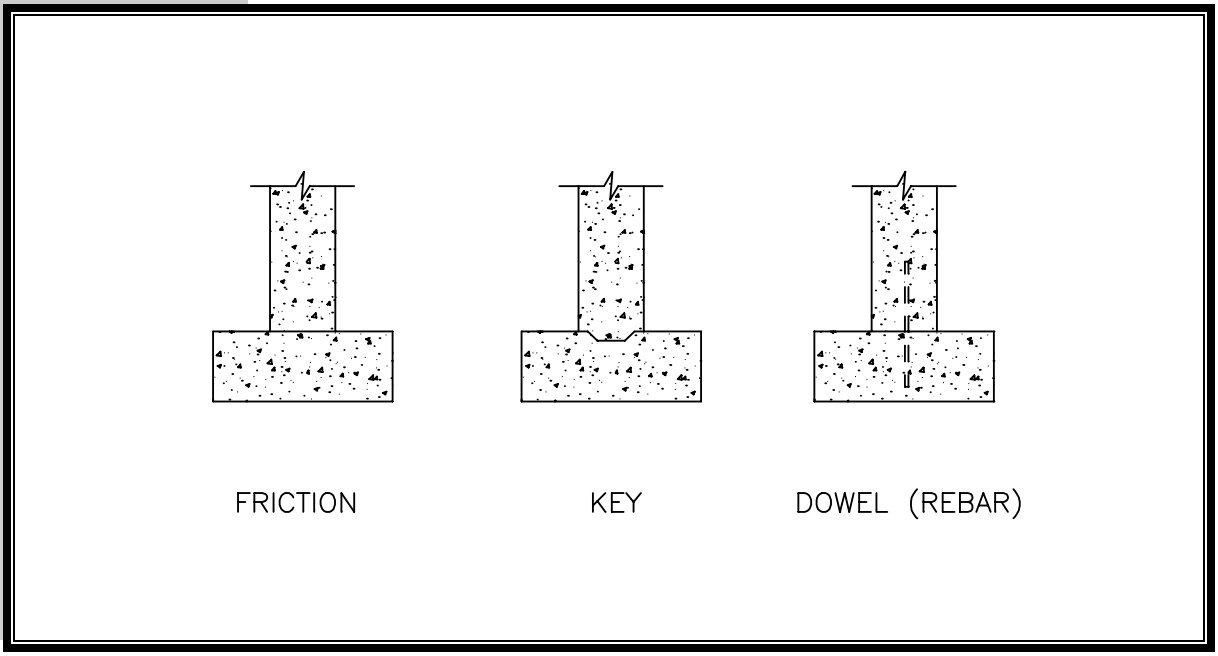
Footing connections, if any, are intended to transfer shear loads from the wall to the footing below. The shear loads are generally produced by lateral soil pressure acting on the foundation (see Chapter 3).

Footing-to-wall connections for residential construction are constructed in any one of the following three ways (refer to Figure 7.5 for illustrations of the connections):

- no vertical reinforcement or key;
- key only; or
- dowel only.

Generally, no special connection is needed in nonhurricane-prone or low- to moderate-hazard seismic areas. Instead, friction is sufficient for low, unbalanced backfill heights while the basement slab can resist slippage for higher backfill heights on basement walls. The basement slab abuts the basement wall near its base and thus provides lateral support. If gravel footings are used, the unbalanced backfill height needs to be sufficiently low (i.e., less than 3 feet), or means must be provided to prevent the foundation wall from slipping sideways from lateral soil loads. Again, a basement slab can provide the needed support. Alternatively, a footing key or doweled connection can be used.

FIGURE 7.5 ***Concrete or Masonry Wall-to-Footing Connections***



Friction Used to Provide Shear Transfer

To verify the amount of shear resistance provided by friction alone, assume a coefficient of friction between two concrete surfaces of $\mu = 0.6$. Using dead loads only, determine the static friction force, $F = \mu NA$, where *F* is the friction force (lb), *N* is the dead load (psf), and *A* is the bearing surface area (sf) between the wall and the footing.

Key Used to Provide Shear Transfer

A concrete key is commonly used to "interlock" foundation walls to footings. If foundation walls are constructed of masonry, the first course of masonry must be grouted solid when a key is used.

In residential construction, a key is often formed by using a 2x4 wood board with chamfered edges that is placed into the surface of the footing immediately after the concrete pour. Figure 7.6 illustrates a footing with a key. Shear resistance developed by the key is computed in accordance with the equation below.

[ACI-318•22.5]

$$V_u \le \phi V_n$$

$$V_n = \frac{4}{3}\sqrt{f'_c}\,bh$$